



FLORIDA SOLAR ENERGY CENTER

Creating Energy Independence Since 1975

Solar Energy for Disasters

David Block
Bill Young

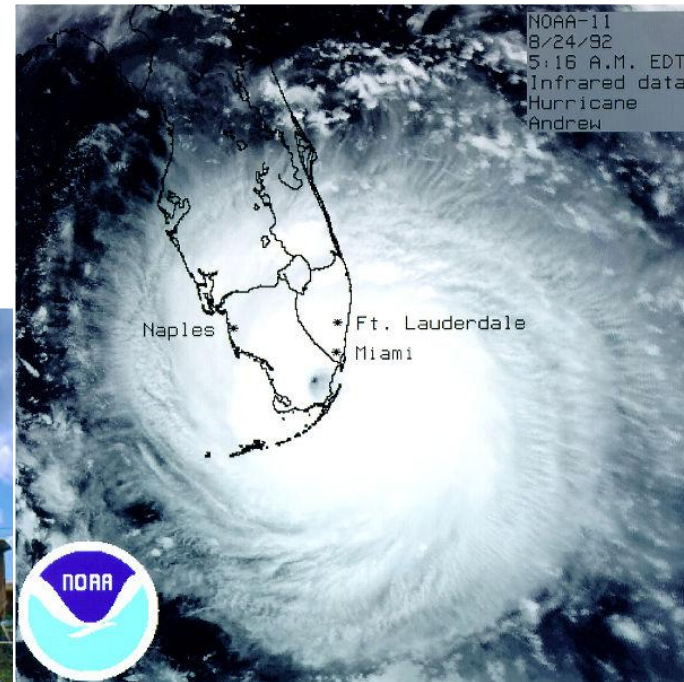
NASA
Overview Meeting
2006

A Research Institute of the University of Central Florida





Disaster Relief





Examples of Disasters



Natural	Man-made
<ul style="list-style-type: none">▪ Earthquakes▪ Hurricanes▪ Tornadoes▪ Floods▪ Lightening storms▪ Mud slides▪ Volcanoes▪ Fires	<ul style="list-style-type: none">▪ Hazardous materials▪ Nuclear accidents▪ Power outages▪ Terrorist attack▪ Fires



Impact of a Disaster



- Individual lives
- Homes
- Businesses
- Communities
- Environment
- Resources
- Economy
- Electrical service
- Water and sewage
- Communications
- Medical services
- Jobs



Life goes on ... living amongst the devastation



Why no generators?



Generator on front porch burns down house.
Proper electrical connection to code should be used.



At work after Hurricane Andrew



When Hurricane Andrew struck (1992), FDOT and Brevard County Emergency Management requested assistance for applying PV to power transportation devices and Emergency Amateur Radio Communication. Shown here: PV training system used at a Miami distribution center.



FSEC responding to Andrew



Hurricane Andrew damaged a Senior Center in Homestead, Florida. It became a medical clinic powered by a 1 kWp PV system with a 2 kW inverter and batteries. Clinic was operated by FEST from University of Miami.



Emergency Management



Phases of Operation and Planning:

- Pre-planning
- Disaster Response
- Long-term Recovery
- Mitigation



Impacts to Utilities Following a Disaster



Power outages due to system failures:

- ❖ Weather
- ❖ Physical failure
- ❖ Human error
- ❖ Market-based instability
- ❖ Intentional disruption





Renewable Energy Sources



- Photovoltaic (PV)
- Solar thermal
- Geothermal
- Small hydro
- Biomass
- Wind
- Micro-Turbine





Lighting Systems Before and After Hurricane Andrew



Before Hurricane Andrew, Picture Facing N.E.



After Hurricane Andrew, Picture facing N.W.

26 such systems survived Hurricane Andrew
Systems provided by Solar Outdoor Lighting of Florida



Highway Message Signs



- ✚ PV powered traffic devices with battery storage for 24 hour-a-day operation helps traffic move freely and safely.
- ✚ Dual use.

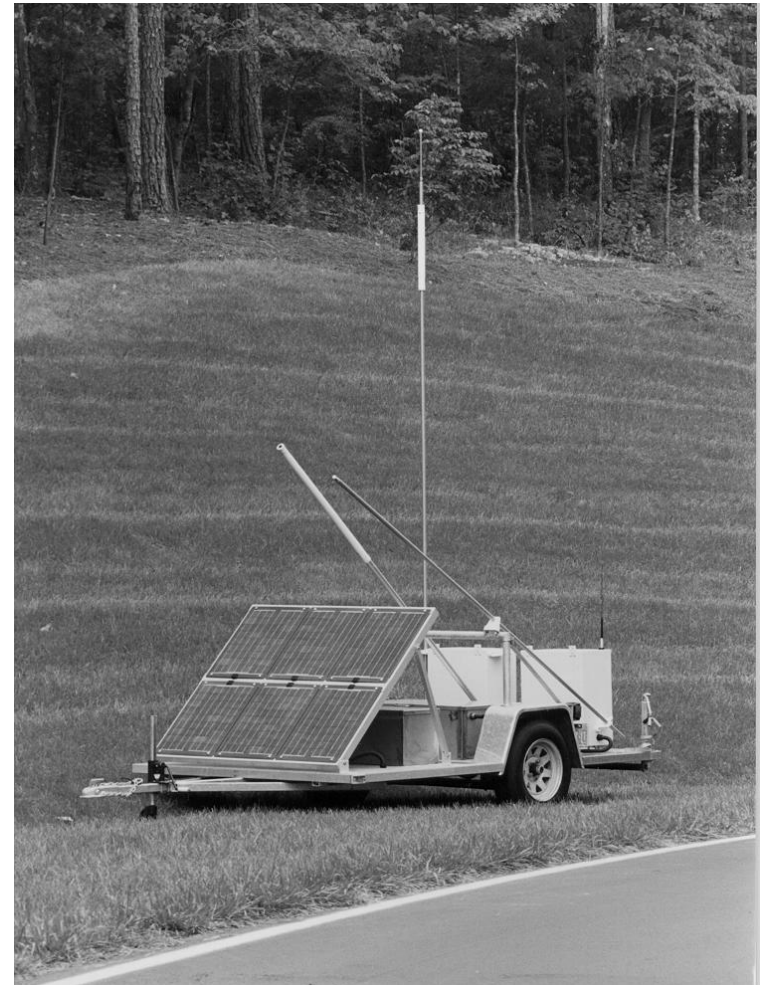




AM Highway Advisory Radio Transmitter



- ✦ FSEC and FDOT program
- ✦ Before hurricane ⇒
transmitted info about
tolls and rest areas
- ✦ After hurricane ⇒
transmitted info on road
hazards and route changes
in disaster area
- ✦ Unit can be applied to
dual use





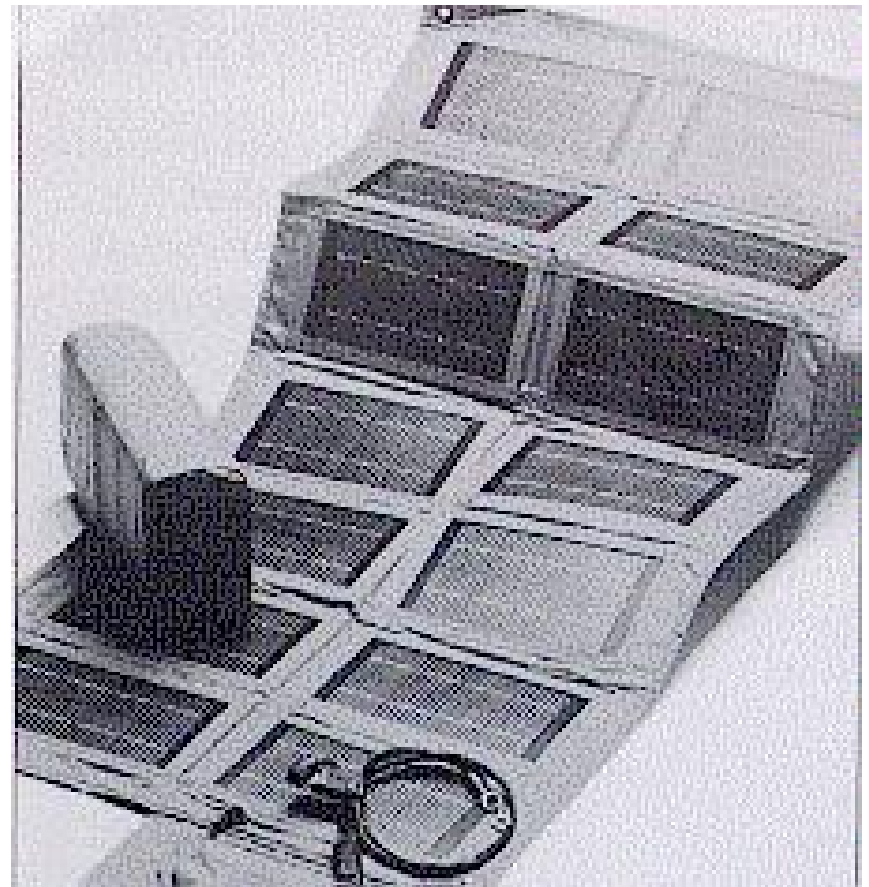
Communications



FSEC and SNL helped PV industry developed a Portable PV generator for satellite telephone application.



Portable PV Chargers



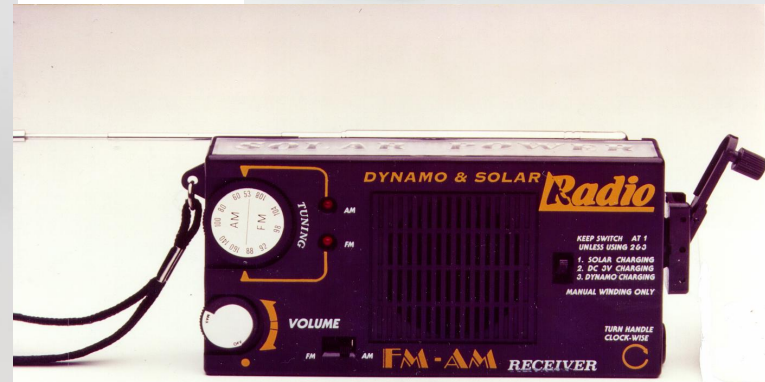


Portable PV Chargers....





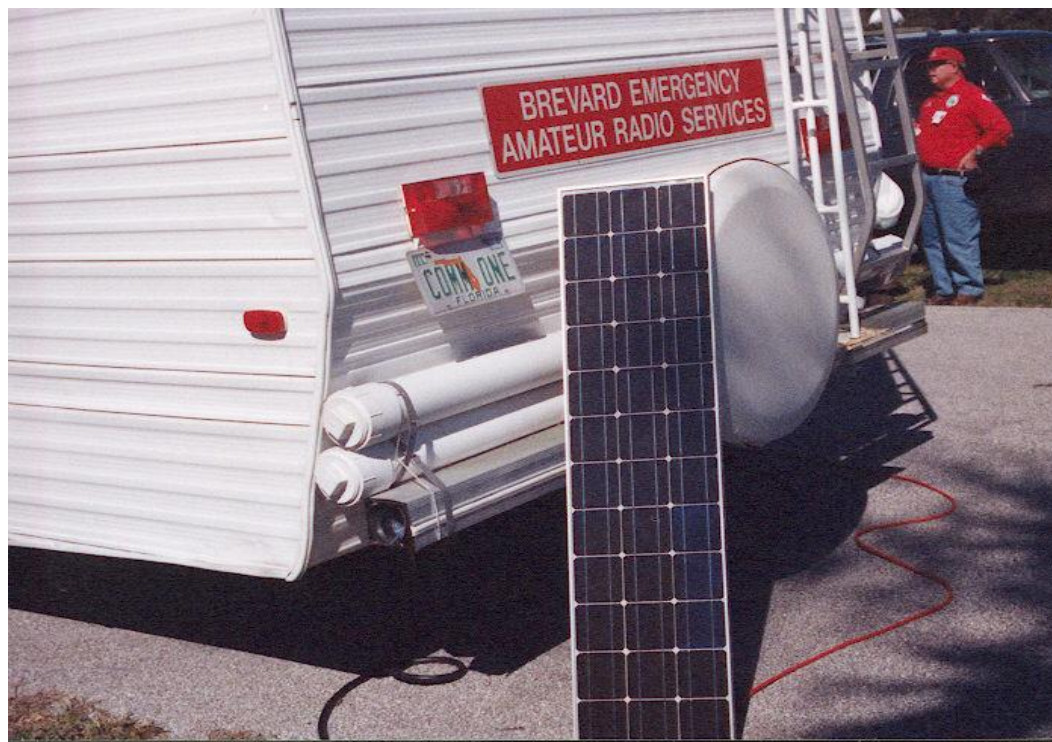
PV-Powered Radios



PV Integrated into Equipment for Specific Use



Ham Communications



FSEC and SNL developed portable power tote for BEARS that was used in Mims, Florida – Fires of 1998



PV Weather station and Communications



Developed a PV powered home weather station with amateur radio packer communication for the National Hurricane Center and ARES to be used as a mobile unit to track hurricanes





Brevard County EOC



PV powered amateur radio weather station in Rockledge



Distribution Center



Miami, Florida – Hurricane George



Catholic Charities POD



Bruce Netter solar mobile office at distribution center in Miami, Florida – Hurricane George



DOE / FEMA Mobile PV Generator



0.5 kWp PV in Big Pine Key, FL
Powering comfort station
Hurricane George



1.8 KWp PV in
Knotts Island, NC
Powering special needs
NCSC and FSEC team
Hurricane Bonnie



Shelter at BCC/UCF Cocoa Campus



FSEC PV Trailer stationed as standby for power near Diesel Generator



NREL Mobile PV Generator



His new home is a tent for the special needs person Everett Cook



Powering an oxygen generator, lights and a fan after Katrina



0.5 kWp PV
generator trailer
in
Pearlington, Miss.



FEO/FSEC Mobile PV Generator



Sara Allen, DJ and radio engineer, at
Emergency Broadcast Radio Station
studio at Kilm temporary EOC



500 Wp PV trailer powering
WQRZ 103.5 FM radio
studio in Kilm, Mississippi



FEO/FSEC Mobile PV Generator



Powering a emergency amateur radio station and solar cooking diner at a shelter in Pearlington



Katrina: Support PV Electricity



New Life Evangelistic Center
provided 65 Wp PV tripod
system with 750 Wp inverter in
Biloxi



PV distributor Mike Whitney
provides 75 Wp PV cart with
750 Wp inverter in
Mississippi



Hurricane Charlie – FEMA/FL DMAT



FSEC PV Power Trailer



Trailer powering medical treatment tent at Fawcett
Memorial Hospital in Port Charlotte



FEMA trailer camp



One of several trailer camps with hundreds of temporary FEMA trailers for disaster victims. FSEC helped develop trailer specifications.





Damage Assessment



- Homes with solar systems and roofs still on had majority of solar still attached.
- Rebuild America and Energy Star Homes survived including the solar.
- FSEC database of 61 PV buildings had 31 monitored with only 3 systems damaged.
- ORL and RICOWI roof assessment of 428 roofs had 14 solar systems of which 3 were damaged
- Many people with solar hot water could take a hot bath.
- Many people with stand-alone PV maintained power to connected items.



Hurricane Charlie – Pool System



Damage assessment in the city of Punta Gorda



Solar Hot Water System Still There



American Dream Energy Star home after
Hurricane Charlie in Port Charlotte, Florida
August 2004



What To Do ?



- **Respond to a disaster ?**

Solar is effective for
niche applications



Or

- **Mitigate the effects
of a disaster ?**

Proper mitigation
minimizes the need
for response.





Prioritizing Energy Needs



- Evaluate energy needs
- Find ways to conserve
- Choose a level of renewable generation that can work for your situation



Renewable Generation Design



<u>Level</u>	<u>Item</u>	<u>Description</u>	<u>PV Power</u>
1	selected items	outdoor lights, pump, gate control	0-200 W
2	critical items	refrigerator, light, radio, register	200-1000 W
3	backup power	lighting, kitchen, water supply, systems	500-2000 W
4	zero energy	production equals consumption	2000-20+kW
5	producer	net generator beyond consumption	10-100+ kW



Disaster Resistant Concept



- ❖ Disaster-resistant buildings should go beyond conventional building methods and codes
- ❖ Mitigation reduces damage and cost of response and recovery
- ❖ Also means the building is functional and operational
- ❖ Sustainability steps beyond minimum energy codes



Resources Available From FSEC



- ❖ Twenty-eight reports and professional papers on solar use in disasters
- ❖ “Photovoltaics for Disaster Relief” booklet
- ❖ Designed and built FSEC PV emergency trailer
- ❖ Designed and procured PV emergency traffic signals
- ❖ Developed and obtained portable PV equipment for loan program during disasters
- ❖ Tested vehicle emergency power generator
- ❖ Providing PV for shelter schools for Solar For Schools Program
- ❖ Provided web site for international access to information
- ❖ Workshop on using solar in disasters
- ❖ Mold control program from water damage
- ❖ Building energy rating and energy efficient design evaluations
- ❖ Wind structural evaluations and designs



Emergency Power Workshop



- ❖ Developed materials and activities
- ❖ Content:
 - Response to mitigation concepts
 - All solar technologies
 - Promotes Energy Emergency Plans
- ❖ Conducted 34 workshops in 9 different countries
- ❖ Attendance from 20 different disaster organizations



FLORIDA SOLAR ENERGY CENTER

Creating Energy Independence Since 1975



Questions?

Contact:

Bill Young

Florida Solar Energy Center
1679 Clearlake Road
Cocoa, Florida, USA 32922
(321) 638-1443

young@fsec.ucf.edu

www.energyfordisasters.org

A Research Institute of the University of Central Florida

